

Electric Armaments

The Army Electric Armaments Program supports the pursuit and development of technologies that can provide potential leap-ahead capabilities to defeat future threats, including those equipped with reactive armor and active protection systems. Electric armaments technologies relate to the concept of launching projectiles using electrical energy, either exclusively (electromagnetic, or EM, propulsion) or in conjunction with chemical energy from propellants (electrothermal-chemical, or ETC, propulsion).

POTENTIAL "LEAP AHEADS" FOR FUTURE COMBAT SYSTEMS

POTENTIAL FOR DRAMATIC LETHALITY IMPROVEMENTS

- HYPERVELOCITY**
 Current large-caliber guns: 1.6 km/s
 ETC guns (potential): 1.8 - 2.2 km/s
 EM guns (potential): 1.8 - 3.0 km/s (tunable to target)
- HYPERVELOCITY LETHALITY**
 Enhances effectiveness of novel KE penetrators
 Enables defeat of explosive reactive armors
 Enables defeat of counter-KE active protection systems
- HYPERENERGY**
 More mass launched at same velocity
 140-mm performance in a 120-mm cannon (ETC)
 140-mm performance in a 100-mm EM gun
- FLEXIBLE LAUNCH VELOCITIES TO MEET SPECIFIC THREATS**

NO ENERGETIC PROPELLANTS (EM)

- ENHANCED SURVIVABILITY**
SIMPLIFIED LOGISTICS
INCREASED STOWED LOAD

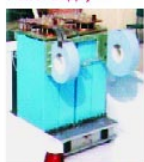
HIGH ENERGY-DENSITY POWER SUPPLIES

SYNERGISTIC WITH ALL-ELECTRIC VEHICLE
 POWERS EM AND ETC GUNS
 ALLOWS DIRECTED-ENERGY WEAPONS
 POWERS ELECTROMAGNETIC ARMORS AND
 ACTIVE PROTECTION SYSTEMS

ELECTROTHERMAL-CHEMICAL PROPULSION

ETC Tactical Round Assessment Test

Power Supply



Volume: 15.2 ft³
 Weight: 1,085 lbs



ATC Barricade 1 / 120mm Cannon

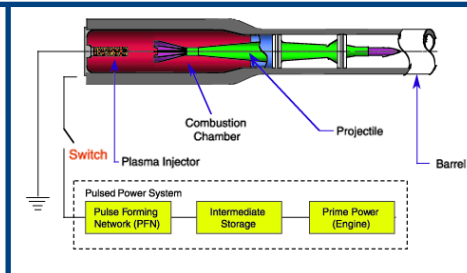


M829A2 ETC Ignition



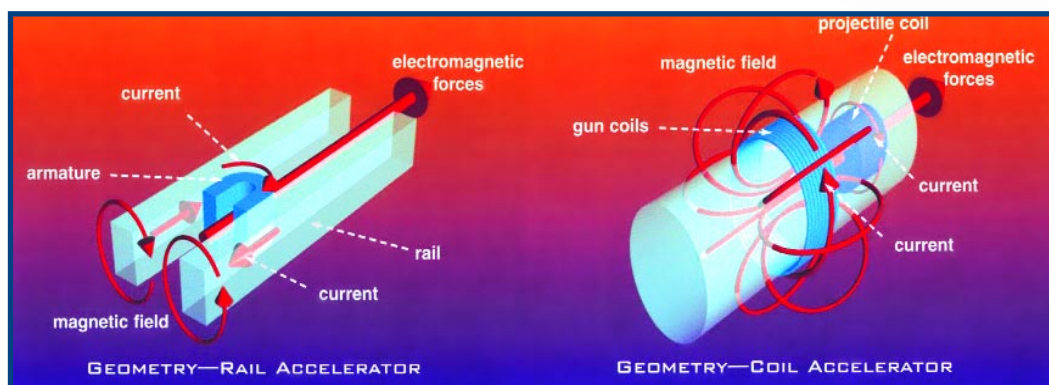
M829A2 ETC Ignition

ETC is a hybrid propulsion concept that utilizes electrical energy to augment and control the release of chemical energy from propellants to achieve significant performance enhancements with existing conventional guns.



ELECTROMAGNETIC PROPULSION

EM launch is a novel propulsion concept that launches projectiles using electromagnetic energy. Electromagnetic forces are generated by the interaction of electric current and magnetic field. Of the two EM gun concepts — rail accelerator and coil accelerator — the rail accelerator concept appears more feasible for potential application in future armaments systems and is currently the only EM launch concept being researched.



**DERA**Defence Evaluation and Research Agency
U.K Ministry of DefenceBundesamt für Wehrtechnik und
Beschaffung (BWB)

DEFENSE THREAT REDUCTION AGENCY

U.S. Army Aberdeen Test
Center

ETC IGNITION AND PROPELLANT TECHNOLOGY

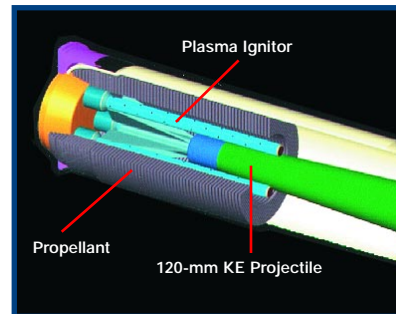
While EM armaments offer the potential for dramatic improvements in performance of combat vehicles, their successful development remains subject to significant investments in long-term research. ETC propulsion technology, on the other hand, may provide near-term enhancements to vehicle armament systems. Apart from yet-to-be-solved issues



Notional Future Combat Vehicle with ETC Main Armament

associated with system integration, the primary technical challenge of ETC propulsion is the need to develop new high-energy, reduced-vulnerability propellants.

Compatibility of ETC ignition concepts with existing armament systems has been demonstrated in tests using the M256 120-mm tank cannon. The ETC ignition designs tested include the flashboard large-area radiation emitter (FLARE), triple coaxial plasma ignitor,



Triple Coaxial Plasma Ignitor

and a compact ETC ignitor. The FLARE design has been further tested with a layered propellant configuration, with good progress demonstrated toward the muzzle energy goal.

EM ARMAMENTS TECHNICAL CHALLENGES

• PULSED POWER SUPPLY

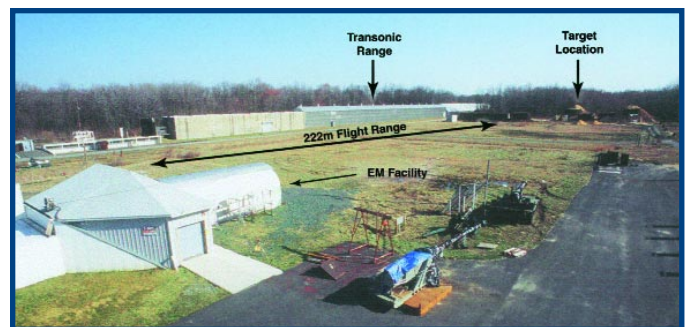
- Meet energy, power, weight, and size requirements
- Apply advanced materials to high-speed rotating machines
- Develop reliable high-power switches

• ELECTROMAGNETIC GUNS

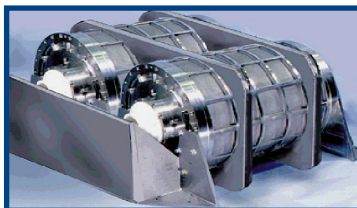
- Meet gun-wear/thermal-management requirements
- Minimize parasitic mass of sabot/armature

• SYSTEM UTILITY

- Demonstrate robustness
- Mitigate EM environment effects

ARL's Medium-Caliber
EM Launch Facility

PULSED-POWER SUPPLY

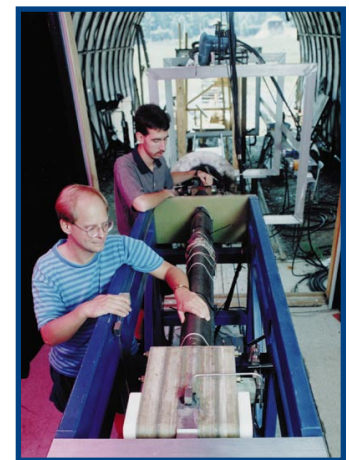
Dual Machine Design of Compensated
Pulsed-Disc Alternator (Compulsator)

Continued progress is being made in pulsed-power technology for EM launchers. Dynamic load testing of the subscale compulsator, a rotating-machine pulsed-power concept selected for EM launch research, has been conducted at close to exit-criteria design specifications.

The compulsator has been successfully tested to 12,000 rpm—the full-performance design point. Accompanying the electro-mechanical design progress is an aggressive materials research effort aimed at developing composite high-speed rotor structures, robust field coils and armatures, and high-power silicon carbide switches.

HYPERVELOCITY LETHALITY

An important element of the Electric Armaments Program is the investigation of the relationship between hypervelocity and projectile lethality. Continuum mechanics modeling and experimentation are demonstrating that novel lethal mechanisms of kinetic-energy penetrators have the potential of defeating advanced armored targets when launched at hypervelocities.



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